# HOW IS WATER DISTRIBUTED THROUGHOUT CALIFORNIA?


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# Background

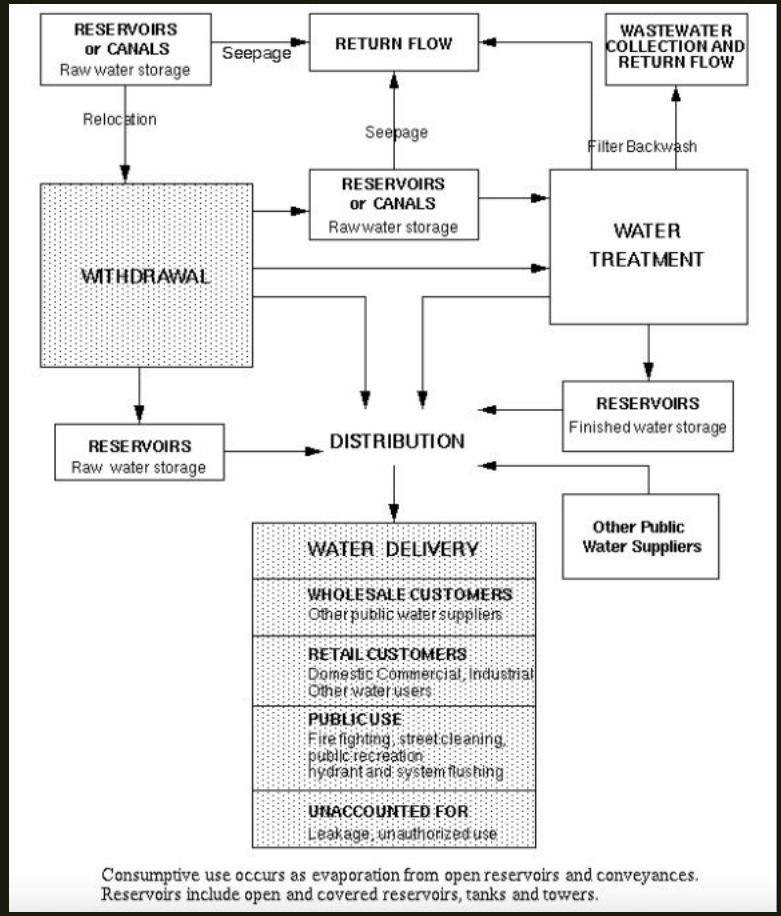
About 71% of the Earth's surface is covered in water but only 2.5% of Earth's water is freshwater. Most of the freshwater is locked up in ice, and another 20.9% is found in lakes. While rivers make up 0.49% of freshwater. Although rivers only account for a small portion of fresh water, this is where humans get most of their water from.

So, in order to distribute the freshwater, it must go through a series of aqueducts and infrastructure that redistribute and transport the water into our homes, schools, and businesses. California receives 75% of their water supply from watersheds north of Sacramento. However, 80% of California's water demand comes from the southern 2/3 of the state. As water isn't distributed equally; Cities, farms, and fish have been in a 3-way tug-of-war for a sustainable water. Streamflow data is important knowledge for governments as it is used in many different circumstances. Streamflow information is used to determine how much water is available in different locations to assure there is an adequate water supply during unknown periods such as droughts.

Important definitions to Know:

**Streamflow** is an important factor in agriculture, crop production, flood management and fire industries that has an impact on the water cycle.

**A percentile** is a value on a scale of one hundred that indicates the percent of a distribution that is equal to or below it.




Overview of water distribution

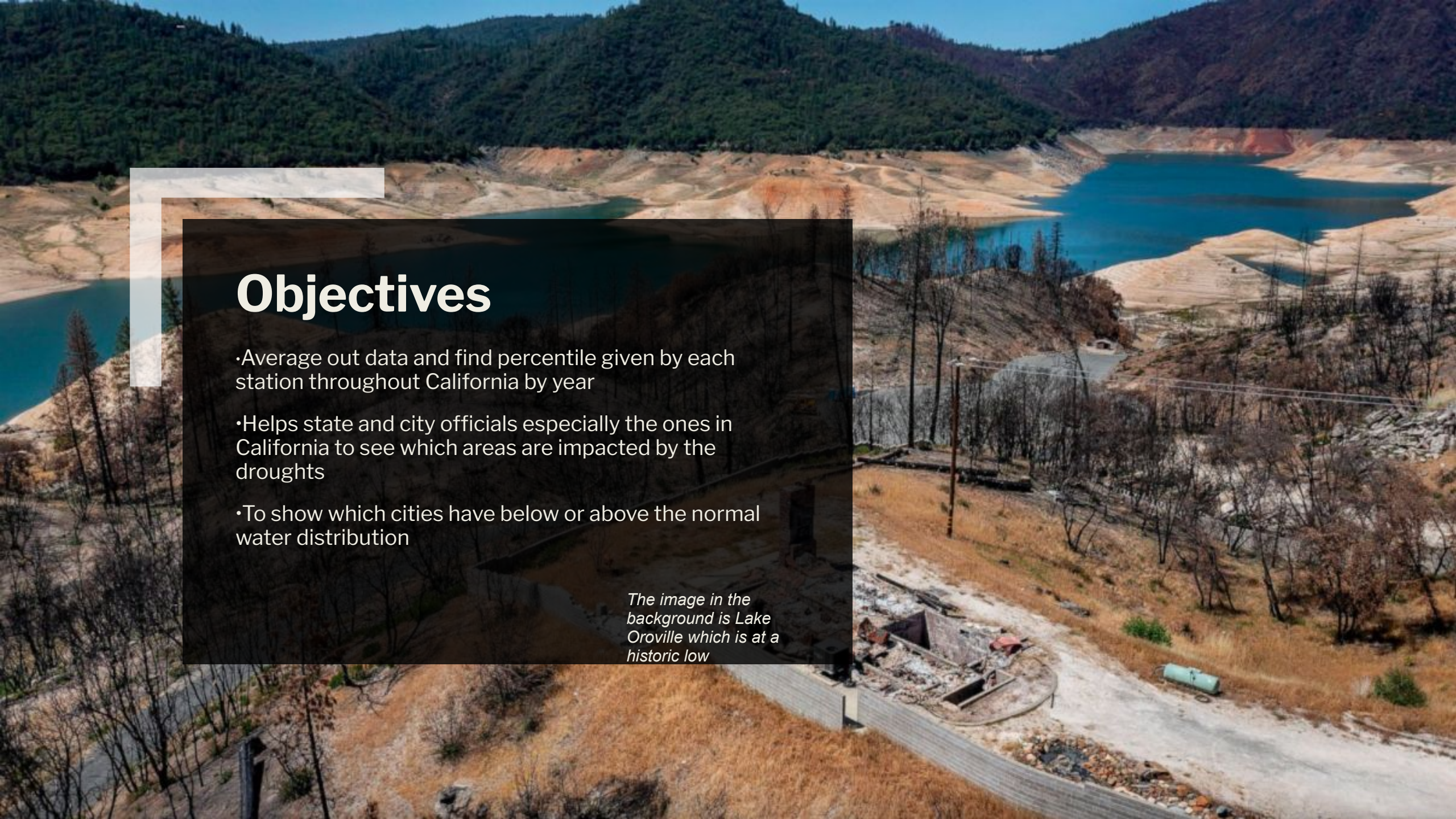
# Why do we need to know about streamflow data?

Due to the effects of climate change on water availability; how we distribute water could soon become an issue in certain regions. California is second to Texas in carbon emission produced per capita and by far, is the most populous state. Due to California's infamous droughts that have been going on since the early 2000s, it is important to know that due to the ever-growing population, contaminated supplies, and potentially changing supplies keeping track and record streamflow data is important to determine if any region is impacted.

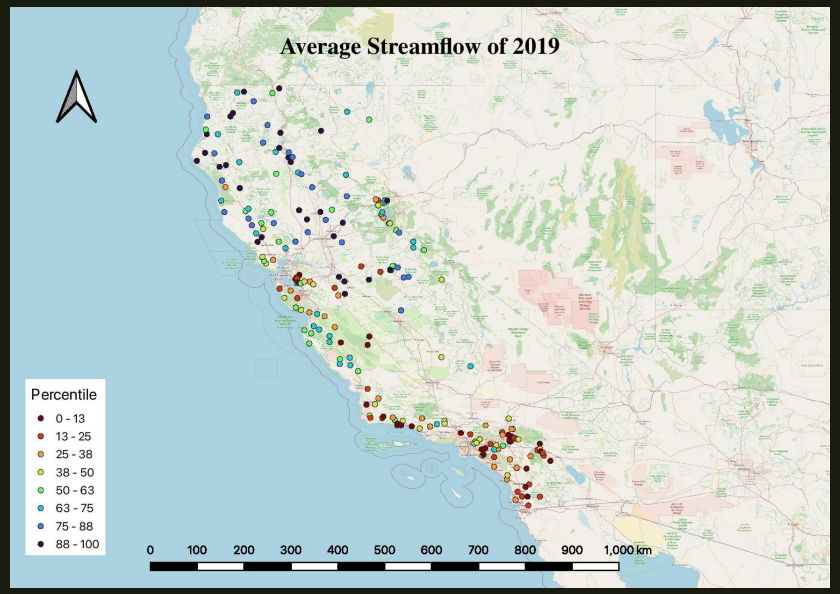
Folsom Lake is a reservoir on the American River in the Sierra Nevada foothills of California. It is located about 25 miles northeast of Sacramento.

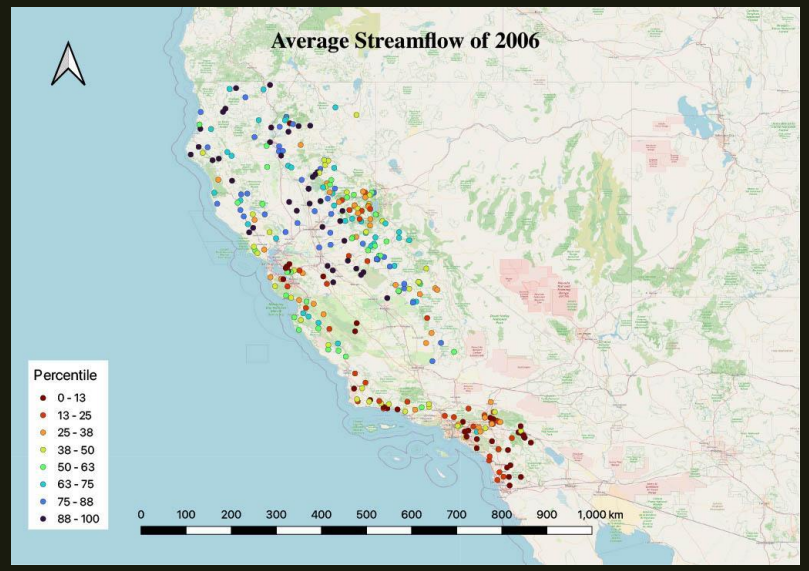
# Objectives

- Average out data and find percentile given by each station throughout California by year
- Helps state and city officials especially the ones in California to see which areas are impacted by the droughts
- To show which cities have below or above the normal water distribution



*The image in the background is Lake Oroville which is at a historic low*





# Methodology

- Our method for creating these maps was to use a software application called QGIS. We used data from U.S. Geological Survey (USGS.gov) and mapped it onto a map of California.
- The data contained daily streamflow, and by using Python we were able to store the data and condense it on a yearly basis by finding the average of these daily streamflow values.
- We filtered the data of each year from 2006 to 2019, so we can see the contrast per year for streamflow average. Through this function, we created 14 different maps for each year.
- We also changed the percentile data points to correlate with greater or lower percentiles of streamflow. As you can see on the legend, red correlates with below normal flows of water. While violet correlates with above normal flows of water.

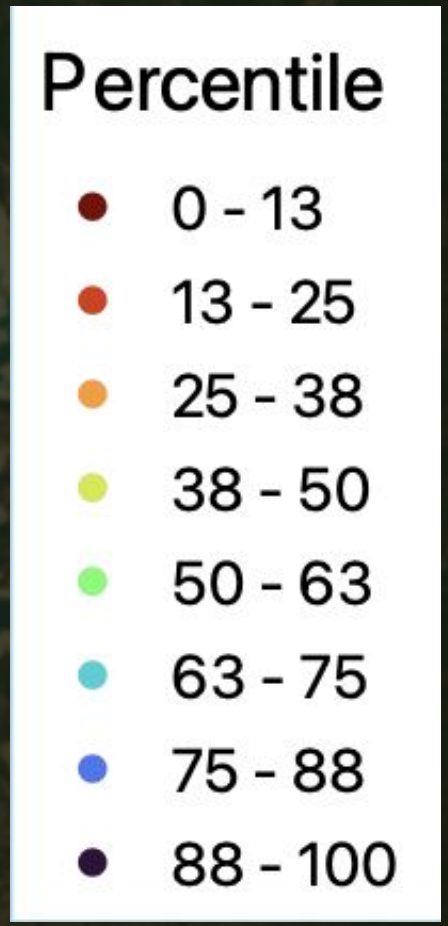
# Results

In general,

- *a percentile less than 25 is considered **below** normal*
- *a percentile between 25 and 75 is considered normal*
- *a percentile greater than 75 is considered **above** normal*

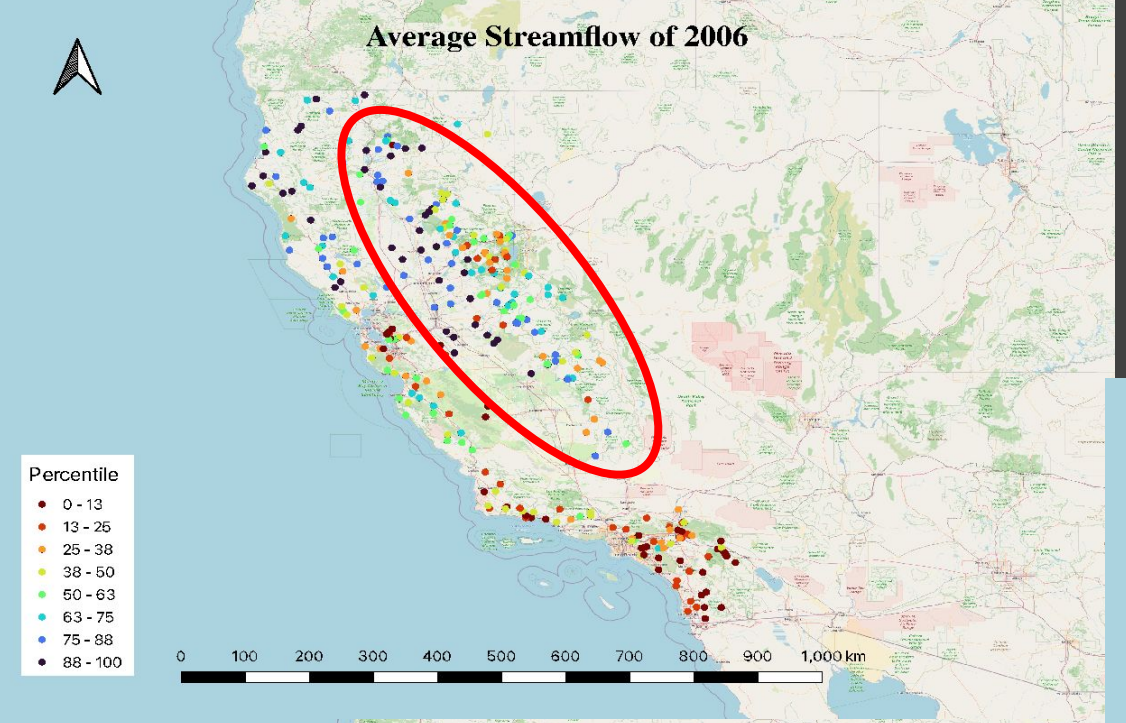
**What we found from the maps was:**

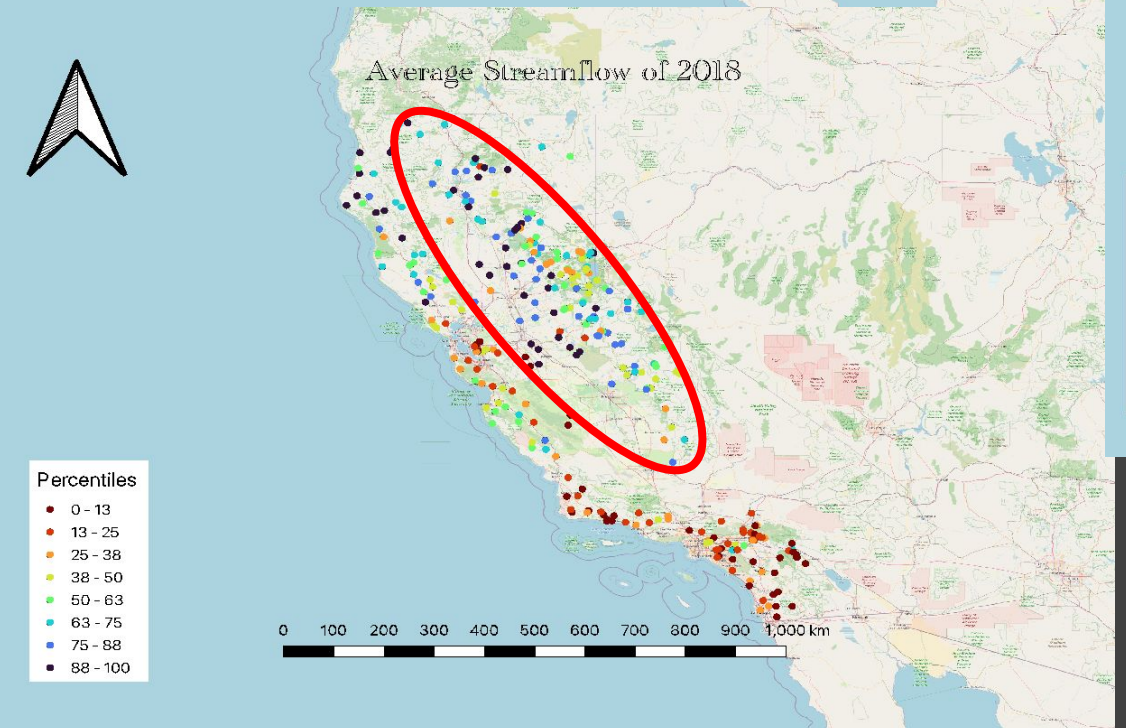
- It had been abundantly clear that in a 14-year span of the two maps that there were more stations in 2006 than 2019
- There was a significant drop in recorded streamflow in 2019 compared to any other year
- In all the maps rural areas and national forest receive more water than most major cities
- For more urban areas there was more water given than to smaller cities

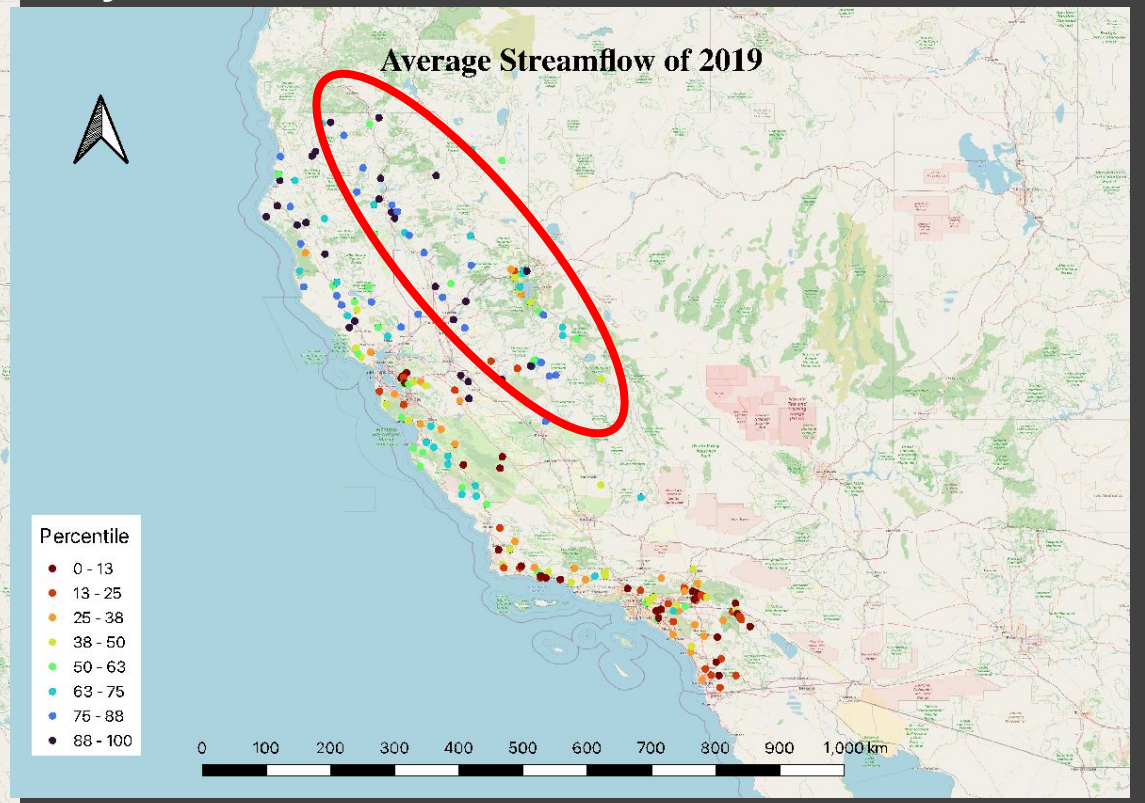


# Results Explained

- You could see that there was a significant drop in recorded streamflow in 2019 compared to any other year



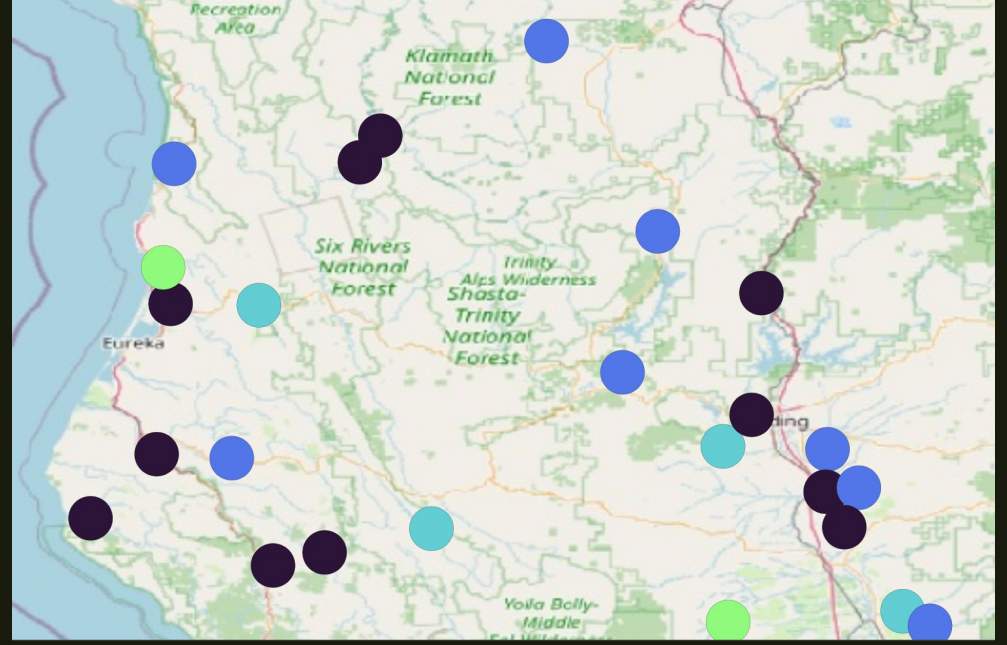



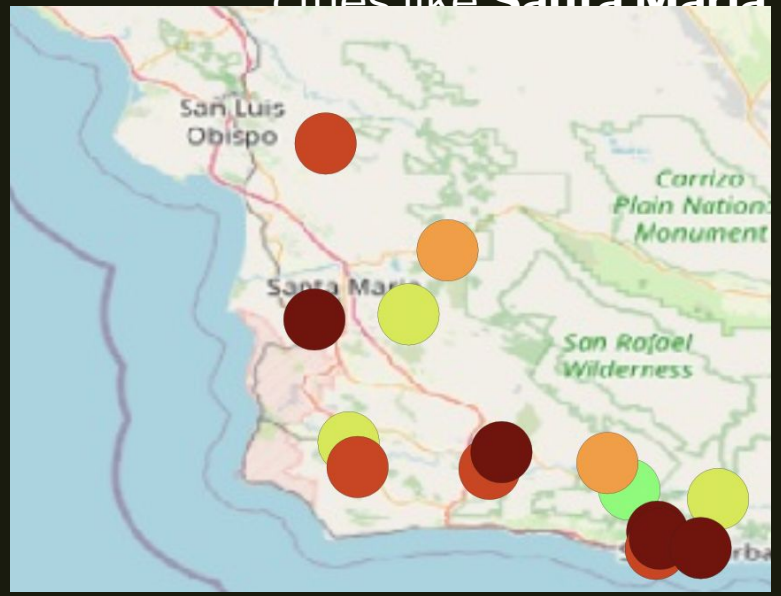

- In a 14-year span of the two maps that there were more stations in 2006 than 2019

# Results Explained Cont.

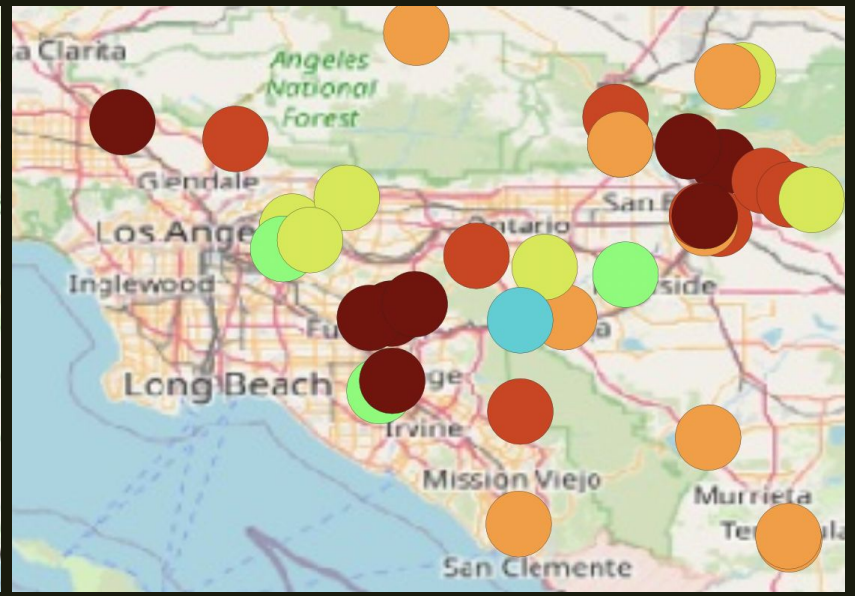
- In all the maps, rural areas such as **Monterey** and national forests such as **The Six Rivers National Forest** receive much more water than most cities like **San Jose** which receives normal to below normal supplies of water
- For larger cities such as **Los Angeles** or **San Diego** there was more water given compared to smaller cities like **Santa Maria**



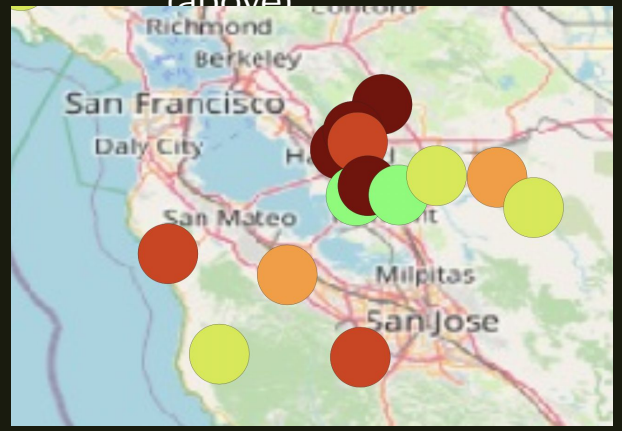

Forest regions have above normal streamflow (above)




Santa Maria has below average streamflow




Los Angeles has normal streamflow




San Jose has below normal streamflow compared to bigger cities like San Francisco

# Conclusion

- The lessening of the water stations could be due to water shortages or an economic gap. As the map had shown national forest do get more water but in 2019 California's southeast forest region has been reduced to a single water station.
- We found that in places like Los Angeles and San Diego more water was distributed than other places like Santa Maria. A reason could be population, according to the 2020 U.S Census, Los Angeles has a population of 3.967 million people while Santa Maria only has 106,224 people.

California’s drought is worsening as reservoirs are shrinking, wildfires are becoming more dangerous, and water supplies are getting more tenuous. California isn’t ready to face the consequences of the near future. So, it is important that California keeps track of where their water is going to because if the California does conserve it water supply or ask all its citizens not just the ones in San Jose to reduce their water usage than California will not recover from this drought.



- https://waterwatch.usgs.gov/?m=real&r=ca
- https://www.usgs.gov/special-topic/water-science-school/science/uses-streamflow-information?qt-science_center_objects=0#qt-science_center_objects
- https://www.census.gov/quickfacts/fact/table/CA,US/PST045219
- https://waterdata.usgs.gov/ca/nwis/rt/
- https://help.waterdata.usgs.gov/faq/surface-water/what-is-a-percentile
- https://ca.water.usgs.gov/data/waterconditionsmap.html
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- https://droughtmonitor.unl.edu/CurrentMap/StateDroughtMonitor.aspx?CAhttps://pubs.usgs.gov/chapter11/chapter11_AFrame_21.gif
- https://apnews.com/article/california-droughts-government-and-politics-science-business-76709d5854394905e0f46880ed6dab9c
- https://www.usgs.gov/media/images/comparison-water-levels-folsom-lake-ca
- https://www.pressdemocrat.com/article/news/best-photos-of-2020-kent-porter/

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